WHAT IS CLAIMED IS:

1. An electromechanical device comprising:

a substrate;

a moveable beam attached to the substrate, the moveable beam being formed from a conductive layer and at least one dielectric layer; and

a fixed beam positioned above and separated from the moveable beam by a cavity, the fixed beam being formed from a conductive layer and a dielectric mechanical support layer.

2. The electromechanical device recited in claim 1, wherein the moveable beam further comprises a polysilicon heater for heating and thereby actuating the moveable beam.

3. The electromechanical device recited in claim 1, wherein an air cavity separates the moveable beam from the fixed beam when the moveable beam is not actuated.

4. The electromechanical device recited in claim 1 further comprising an integrated circuit formed on the substrate, the integrated circuit sensing and controlling the moveable beam's positioning by controlling the current flowing through the moveable beam.

5. The electromechanical device recited in claim 1, wherein the moveable beam is formed by a standard integrated process flow from at least one conductive layer and a plurality of dielectric layers.

6. The electromechanical device recited in claim 1, wherein the fixed beam is formed from at least one conductive layer, a plurality of dielectric layers, and at least one mechanical support layer.

7. The electromechanical device recited in claim 1, wherein the moveable beam is formed from a plurality of conductive layers selected from the group comprising polysilicon, aluminum and copper, and from a plurality of dielectric layers selected from the group comprising doped or undoped silicon dioxide, a form of silicon nitride, or a low-k dielectric.

8. The electromechanical device recited in claim 7, wherein the low-k dielectric is selected from the group comprising SiLK, Black Diamond, Nanoglass E, and Zirkon LK.

9. The electromechanical device recited in claim 1, wherein the fixed beam is formed from a plurality of conductive layers selected from the group comprising gold, copper, silver, platinum, titanium, tungsten, aluminum, nickel, and alloys thereof.

10. The electromechanical device recited in claim 2. wherein the polysilicon layer is enclosed within the moveable beam and contact between the moveable beam and the fixed beam is made or broken by generating heat in the polysilicon layer, whereby the electromechanical device functions as a switch.

11. The electromechanical device recited in claim 1, wherein the moveable beam has a conductive film located at a contact area of the moveable beam, thereby allowing metal-to-metal contact between the moveable beam and the fixed beam.

12. The electromechanical device recited in claim 1, wherein the moveable beam has a dielectric film located at a contact area of the moveable beam, thereby allowing metal-to-dielectric contact between the moveable beam and the fixed beam.

13. The electromechanical device recited in claim 1 further comprising a signal path connected to the moveable beam and a ground plane of a planar waveguide connected to the fixed beam, whereby actuation of the moveable beam so as to contact the fixed beam causes the signal path to be connected to the ground plane.

14. The electromechanical device recited in claim 1 further comprising an electrical potential applied between the conductive layer of the moveable beam and the conductive layer of the fixed beam, whereby the moveable beam is actuated electrostatically by the application of the electrical potential to contact the fixed beam and thereby function as a switch.

15. The electromechanical device recited in claim 2, wherein the polysilicon layer is enclosed within the moveable beam, and wherein the moveable beam is actuated without contacting the fixed beam by generating heat in the polysilicon layer, thereby causing the electromechanical device to function as a tunable capacitor.

16. The electromechanical device recited in claim 1 further comprising an electrical potential applied between the conductive layer of the moveable beam and the conductive layer of the fixed beam, whereby the moveable beam is actuated electrostatically by the application of the electrical potential to not contact the fixed beam and thereby function as a tunable capacitor.

17. The electromechanical device recited in claim 1, wherein the substrate is silicon.

18. The electromechanical device recited in claim 1, wherein the movable beam is connected to the substrate at one point.

19. The method of forming a device as recited in claim 1, wherein the mechanical support layer is selected from the group comprising a screen-printed polyimide, a photoimageable polymer, and a dry-etchable polymer.

20. A electromechanical device comprising:

a semiconductor substrate;

a moveable beam formed on the substrate by a standard integrated process flow from at least one conductive layer and plurality of dielectric layers;

the moveable beam being attached to the substrate at one or more points, the semiconductor substrate being selectively etched underneath the moveable beam;

a fixed beam formed directly above the moveable beam and separated from the movable beam by an air cavity, the fixed beam being formed from at least one conductive layer, plurality of dielectric layers and at least one mechanical support layer; and

an integrated circuit also formed on the substrate, the integrated circuit sensing and controlling the position of the moveable beam by controlling the voltage or current flowing to the movable beam.

21. The electromechanical device recited in claim 20, wherein the moveable beam further comprises a polysilicon heater for heating and thereby actuating the moveable beam.

22. The electromechanical device recited in claim 21 wherein the polysilicon layer is enclosed within the moveable beam and contact between the moveable beam and the fixed beam is made or broken by generating heat in the polysilicon layer, whereby the electromechanical device functions as a switch.

23. The electromechanical device recited in claim 20 further comprising an electrical potential applied between the conductive layer of the moveable beam and the conductive layer of the fixed beam, whereby the moveable beam is actuated electrostatically by the application of the electrical potential to contact the fixed beam and thereby function as a switch.

24. The electromechanical device recited in claim 21, wherein the polysilicon layer is enclosed within the moveable beam and the moveable beam is actuated without contacting the fixed beam by generating heat in the polysilicon layer, whereby the electromechanical device functions as a tunable capacitor.

25. The electromechanical device recited in claim 20 further comprising an electrical potential applied between the conductive layer of the moveable beam and the conductive layer of the fixed beam, whereby the moveable beam is actuated electrostatically by the application of the electrical potential to not contact the fixed beam and thereby function as a tunable capacitor.

26. A method of forming an electromechanical device comprising the steps of:

fabricating a first beam and an integrated circuit monolithically on a semiconductor substrate using standard semiconductor process flows;

patterning an air cavity above the first beam using a sacrificial material;

fabricating a second beam by performing the steps of:

depositing a first conductive material on the sacrificial material by means of sputtering or evaporation;

patterning a sacrificial mold for a second conductive layer;

electrodepositing a thick second conductive layer over the mold;

removing the sacrificial mold and an excess amount of the second conductive layer underneath the mold;

depositing and patterning a mechanical support layer on top of the device;

patterning and etching the semiconductor substrate from a backside of the substrate; and

releasing the first beam so as to be movable by removing the sacrificial material on top of the first beam.

27. The method of forming a device as recited in claim 26, wherein the step of depositing the second conductive layer is followed by a step of polishing the conductive layer.

28. The method of forming a device as recited in claim 26, wherein the steps of depositing the first and second conductive layers are each repeated after a dielectric layer is deposited and patterned over each of the first and second conductive layers.

29. The method of forming a device as recited in claim 27, wherein the dielectric is a mechanical support layer.

30. The method of forming a device as recited in claim 26, wherein the substrate is selected from the group of semiconductor materials comprising Si, SiGe and GaAs.

31. The method of forming a device as recited in claim 28, wherein the mechanical support layer is selected from the group comprising a screen-printed polyimide, a photoimageable polymer, and a dry-etchable polymer.

32. The method of forming a device as recited in claim 26 further comprising the step of forming a polysilicon heater in the movable beam for heating and thereby actuating the moveable beam.

33. The method of forming a device as recited in claim 26, wherein the first beam is fabricated from a plurality of conductive layers selected from the group comprising polysilicon, aluminum and copper, and from a plurality of dielectric layers selected from the group comprising doped or undoped silicon dioxide, a form of silicon nitride, or a low-k dielectric.

34. The method of forming a device as recited in claim 32, wherein the low-k dielectric is selected from the group comprising SiLK, Black Diamond, Nanoglass E, and Zirkon LK.

35. The method of forming a device as recited in claim 26, wherein the second beam is fabricated from a plurality of conductive layers selected from the group comprising gold, copper, silver, platinum, titanium, tungsten, aluminum, nickel, and alloys thereof.

36. The method of forming a device as recited in claim 26 wherein, the step of fabricating the first beam includes locating a conductive film at a contact area of the first beam, thereby allowing metal-to-metal contact between the first beam and the second beam.

37. The method of forming a device as recited in claim 26 wherein, the step of fabricating the first beam includes locating a dielectric film at a contact area of the first beam, thereby allowing metal-to-dielectric contact between the first beam and the second beam.

38. A method of forming an electromechanical device comprising the steps of:

fabricating a moveable beam and an integrated circuit on a semiconductor substrate using standard semiconductor process flows;

patterning an air-gap above the movable beam using a sacrificial material;

fabricating a fixed beam by:

depositing a thick conductive film on the sacrificial material by means of sputtering or evaporation;

patterning the conductive film via standard photolithography; and

etching the conductive film;

depositing and patterning a mechanical support layer on top of an area covered by the device;

patterning and etching the semiconductor substrate from a backside of the substrate; and

releasing the moveable beam by removing the sacrificial layer placed on top of the moveable beam.

39. The method of forming a device as recited in claim 38 further comprising the step of forming a polysilicon heater in the movable beam for heating and thereby actuating the moveable beam.

40. The method of forming a device as recited in claim 38wherein, the step of fabricating the movable beam includes locating a conductive film at a contact area of the moveable beam, thereby allowing metal-to-metal contact between the movable beam and the fixed beam.

41. The method of forming a device as recited in claim 38 wherein, the step of fabricating the movable beam includes locating a dielectric film at a contact area of the moveable beam, thereby allowing metal-to-dielectric contact between the movable beam and the fixed beam.

42. The method of forming a device as recited in claim 38, wherein the mechanical support layer is selected from the group comprising a screen-printed polyimide, a photoimageable polymer, and a dry-etchable polymers.